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ENCLOSURES *(Check all that apply)*

- [ ] Fee Transmittal Form
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Date	March 25, 2005	Reg. No.	44,037

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Nina L. McNeill

PATENT
Attorney Docket No. A4231/T34410
AMAT No.
A4231/USA/D01/DSM/HDP/CVD/JW
TTC No. 016301-034410US

IN THE UNITED STATES PATENT AND TRADEMARK OFFICE
BEFORE THE BOARD OF PATENT APPEALS AND INTERFERENCES

In re application of: Michael Kwan et al. Application No.: 09/920,891 Filed: August 2, 2001 For: GAS CHEMISTRY CYCLING TO ACHIEVE HIGH ASPECT RATIO GAPFILL WITH HDP-CVD	Examiner: Kackar, Ram N. Art Unit: 1763 SUPPLEMENTAL REPLY BRIEF UNDER 37 CFR §41.41

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Sir:

In response to the Supplemental Examiner's Answer mailed February 4, 2005, Applicants request that the appeal be maintained and file this Supplemental Reply Brief in accordance with 37 C.F.R. §41.50(a)(2)(ii).

1. Introduction

The Supplemental Examiner's Answer ("Answer") was provided in response to a Remand to the Examiner issued by the Board on January 19, 2005 in which the Board requested clarification of the ground for rejection. The Answer states that Claims 17 – 22 stand rejected under 35 U.S.C. §103(a) as unpatentable over U.S. Pat. No. 5,990,000 ("Hong") in view of U.S. Pat. No. 6,030,881 ("Papasouliotis") as evidenced by U.S. Pat. 5,937,323, ("Orczyk"), U.S. Pat. No. 6,310,755 ("Kholodenko"), and U.S. Pat. No. 5,316,278 ("Sherstinsky").

Establishment of a *prima facie* case under §103(a) requires a demonstration that all limitations of the claims be taught or suggested by the cited references, that there be some suggestion or motivation to combine or modify the reference teachings as proposed, and that there be a reasonable expectation of success. MPEP 2143. Applicants understand the rejection to rely substantively only on the combination of Hong and Papasouliotis for the specific claim limitations, with Orczyk, Kholodenko, and Sherstinsky relied on "as evidence" for certain assertions made in articulating the basis for rejection otherwise made only over Hong in view of Papasouliotis.

The Answer does not integrate Orczyk, Kholodenko, or Sherstinsky within the ground for rejection to rely on them for specifically cited limitations. Instead, Orczyk is cited as evidence for the assertion that "chemical vapor deposition typically requires elevated temperature" (Answer, p. 5), and Kholodenko and Sherstinsky are cited independently as evidence showing that certain etching processes involve "cooling" the wafer (*id.*, p. 5).

2. The Cited Art Does Not Teach or Suggest the Cooling Step

The discussion in the earlier briefs has focused on whether there is any teaching or suggestion in the cited art of a separate cooling step as required by the claims. The Answer implicitly acknowledges that none of the cited references explicitly discloses such a separate cooling step, and instead constructs an argument based on (1) the disclosure of Papasouliotis that a transition from a deposition step to an etching step may be effected by changing several

parameters, one of which may include temperature; (2) a suggestion in Hong and Orczyk that certain chemical-vapor-deposition processes are performed at "elevated temperature"; and (3) teachings from Kholodenko and Sherstinsky that certain etching processes use "cooling" to maintain a substrate temperature within a narrow range (*id.*, p. 5, *see also id.*, pp. 7 – 8).

What is relevant in evaluating the cooling step recited in the claims is the relative temperature of the first deposition and the etching. Both Hong and Papasouliotis are silent on this, and it is respectfully believed that the additional evidence provided by Orczyk, Kholodenko, or Sherstinsky adds little relevant information on this issue beyond what is already disclosed in Hong and Papasouliotis. In particular, as the Answer correctly notes, Hong teaches that chemical vapor deposition is typically performed at an elevated temperature (Answer, p. 5). Orczyk explains that this is helpful "to induce the reactions necessary to form a layer" (Orczyk, Col. 1, ll. 31 – 32), but also notes that frequently methods are used to lower the required deposition temperature (*id.*, Col. 1, ll. 32 – 39). Etching is also typically performed at an elevated temperature, and Papasouliotis notes the desirability of modulating the temperature during etching so that temperature *variations* are small (Papasouliotis, Col. 8, ll. 23 – 26). Kholodenko is especially clear in explaining that modulating the temperature during etching to maintain it in a narrow range is desirable to counteract temperature *fluctuations* that occur in high-power plasmas (Kholodenko, Col. 1, l. 56 – Col. 2, l. 3).

It is true that Kholodenko contemplates circumstances in which the etch temperature is lower than the etch-plasma temperature so that temperature modulation is achieved by "cooling the wafer" (*id.*, Col. 2, l. 2) and that Sherstinsky contemplates similar circumstances (Sherstinsky, Col. 1, ll. 15 – 27). But it does not follow as a general principle from these two examples that all etch-temperature modulation must be performed at a temperature lower than the plasma temperature. Papasouliotis itself notes that the temperature modulation may be achieved by "cooling" or "heating" the wafer, depending on whether the etch temperature is to be greater or lower than the plasma temperature:

> Thus, the range of operating pressures and the power levels used in the etching steps are chosen to satisfy this requirement [that cusps be removed without corner clipping]. Wafer temperature can

> be modulated either by clamping the wafer on the electrostatic chuck (ESC) and cooling the wafer using He or by using a heated ESC.
> (Papasouliotis, Col. 8, ll. 21 – 26).

Other examples of etching being performed at increased plasma temperatures have been discussed during prosecution of the application, notably in connection with U.S. Pat. No. 6,015,760 ("Becker"), originally cited in an Office Action mailed on June 24, 2002 for teaching a dependence of chemical etching characteristics on temperature (*see also* Appellant Brief, p. 6, n. 1). As noted in the Response filed on August 26, 2002, Becker specifically teaches the following:

> The process of the present invention meets the above-described existing needs by forming on etched multilayer structure, in which the sidewalls of the SiO_2 layer are substantially normal to the substrate, at a high SiO_2 etch rate, and at a high selectivity of SiO_2 with respect to the underlying Si_3N_4. This is accomplished by *heating* various portions of the etch chamber while employing a process for etching the SiO_2 layer down to the Si_3N_4 stop layer.
> (Becker, Col. 2, ll. 57 – 67, emphasis added).

The Answer does not argue that the supplementary evidence provided by Orczyk, Kholodenko, and Sherstinsky be integrated as part of a combination of Hong and Papasouliotis. Importantly, the combination of Hong and Papasouliotis provides no information on which one can conclude what the relative temperatures of the <u>deposition and etching phases</u> should be in the claimed method. The evidence selected for citation in the Answer suggests that there are some processing conditions under which etching is performed at a modulated temperature less than the etch-plasma temperature, although other evidence suggests that there are processing conditions under which the opposite is true. Papasouliotis itself is noncommittal, suggesting that the etching might be performed at a modulated temperature less than or greater than that of the etch-plasma. But this analysis is largely peripheral to the issue because it focuses on the relative temperature of an etch process and the etch-plasma temperature during that etch process — none of the references teaches or suggests any specific temperature relationship <u>between the deposition and etching steps</u>, and consequently fails to teach or suggest that there be a separate cooling step between the first deposition and the etching.

At best, the Answer articulates an "obvious to try" rationale in which an etch temperature lower than the deposition temperature might be tried because the prior art includes examples of processes in which an etch temperature less than the etch-plasma temperature is advantageous. The fact that the Answer is indeed relying on an "obvious to try" rationale is evident from language used in characterizing the prior-art teachings:

> Papasoliotis et al indicate that in general, a change of temperature may be required after deposition in preparation for the etch. Considering this in view of the knowledge (Hong and Orczyk et al) that, plasma deposition in general is accompanied by an elevation in temperature while etching needs cooling the substrate, even if to maintain substrate at a lower temperature, it would have been obvious that in general a cooling step after deposition may be needed in preparation for etching, at least in case, change of temperature in Papasoliotis turns out to be cooling for a specific process.
> (Answer, p. 7, emphasis added).

"[W]hether a particular combination might be 'obvious to try' is not a legitimate test of patentability." *In re Fine*, 837 F.2d 1071, 1075, 5 USPQ2d 1596, 1599 (Fed. Cir. 1988). It is apparent that the prior art is diverse and that there are many avenues that might have been tried. The Answer improperly fails to "consider[] the degree to which one reference might accurately discredit another" when "the teachings of two or more prior art references conflict." MPEP 2143.01. Since the Office has failed to establish that the cited art teaches or suggests the cooling limitation, it is respectfully believed that the claims are patentable.

3. There is No Motivation to Combine Hong with Papasouliotis as Suggested

Applicants have previously noted that Papasouliotis includes specific cautions about significant chemical and physical differences between PECVD applications like those discussed in Hong and the HDP-CVD applications discussed in Papasouliotis. The Answer suggests that a motivation to combine the two may be found in Hong's indication that its "description is mainly for illustrative purposes" and that "[o]ther CVD equipment such as electron cyclotron resonance (ECR) plasma CVD devices, induction-coupled RF high-density plasma CVD devices, or the like may be employed" (Hong, Col. 5, ll. 26 – 30). While these

statements may reasonably suggest that the specific process described in Hong could be implemented with an HDP-CVD chamber, they do not go so far as to suggest that the specific process described in Papasouliotis be integrated with its process.

It is improper to ignore the contrary statements in Papasouliotis warning against the equivalence of HDP-CVD and PECVD steps for its dep/etch/dep process. "A prior art reference must be considered in its entirety, i.e. as a <u>whole</u>, including portions that would lead away from the claimed invention." MPEP 2141.02, *citing W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 220 USPQ 303 (Fed. Cir. 1983), *cert. denied*, 469 U.S. 851 (1984) (emphasis in original). The need to give due consideration to the admonitory statements in Papasouliotis is especially acute since they were made specifically in the context of describing a process very much like that disclosed in Hong (*see* Papasouliotis, Col. 1, l. 58 – Col. 2, l. 10 setting the context for its discussion of differences between PECVD and HDP-CVD by describing a process of PECVD deposition, followed by a sputter etch, followed by a subsequent PECVD deposition).

For each of the above reasons, it is respectfully believed that the claims are patentable.

Respectfully submitted,

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